MULTIMEDIA UNIVERSITY

STUDENT ID NO

Seat No.: | | | |

Venue: _____

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

TGD2151 – COMPUTER GRAPHICS FUNDAMENTALS

(All sections / Groups)

7 MARCH 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

Question No.	Marks
1	
2	
3	
4	
Total	

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 9 pages with 4 Questions only.

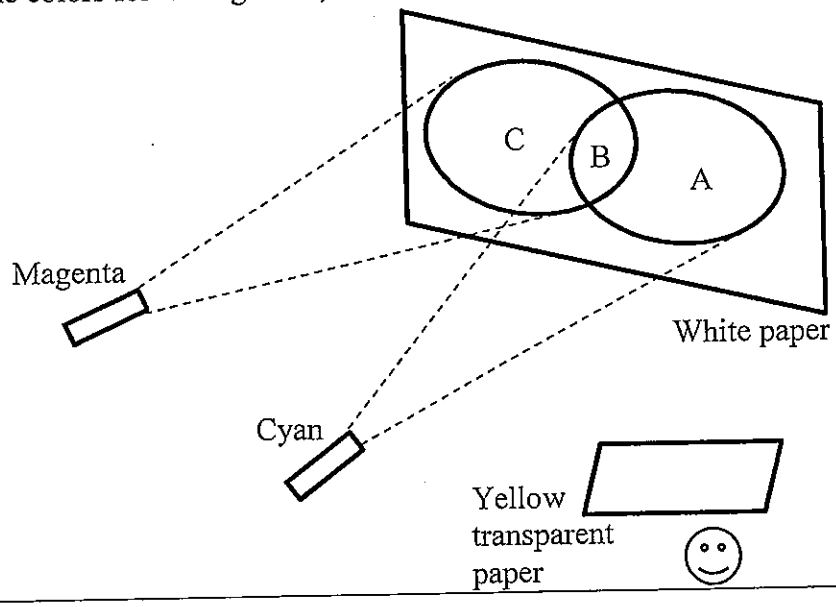
2. Answer **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers CLEARLY in this Question paper.

QUESTION 1

a) (i) List down the component values of the "Blue" color in HSV color system.
(ii) List down the component values of the "Blue" color in CMY color system.
[2 marks]

b) Two light sources of Magenta and Cyan color are shone on a white paper as shown in the figure below. A viewer visualizes the white paper through a yellow transparent paper. Determine the colors for the region A, B and C observed by the viewer.
[3 marks]



Continued...

c) Given two vectors $\mathbf{V}_1$ (a, 1, 2) and $\mathbf{V}_2$ (2, 2, 4) which are orthogonal to each other. Create a parametric equation for a line **L** if it passes through a point P_0 (8, 3, -2) and parallel to $\mathbf{V}_1$.

[3 Marks]

d) Below is the formula for the Midpoint line drawing algorithm.

$F_0 = h - w/2$
Given $F_k < 0$, $y_{k+1} = y_k$, then $F_{k+1} = F_k + h$
Given $F_k \geq 0$, $y_{k+1} = y_k + 1$, then $F_{k+1} = F_k + h - w$

Compute the pixel coordinates of a line that starts at P_0 (3, 3) and ends at P_5 (8, 7).

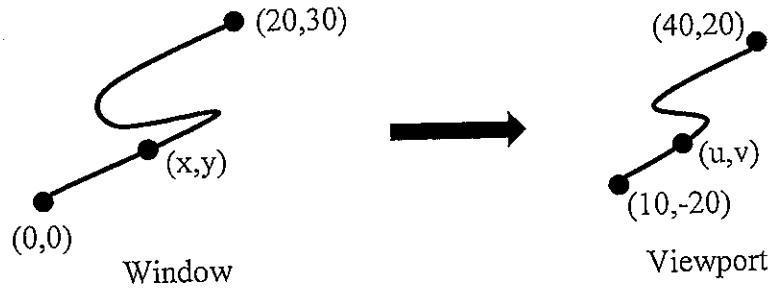
[2 Marks]

Continued...

QUESTION 2

a) (i) Write the window to viewport transformation for the figure below.

[3 marks]



(ii) Is the transformation in 2(a) distortion free? [1 mark]

(iii) What is the corresponding viewport coordinate for a given window coordinate at (14, 12)? [2 marks]

Continued...

b) Write a composite matrix for a 2D transformation which begins with reflection about an origin, followed by 90 degree counter-clockwise rotation and translated with translation factor (4, 3).

[3 marks]

c) Complete the OpenGL transformation code in the blanks below to perform the transformation in 2(b)?

[1 mark]

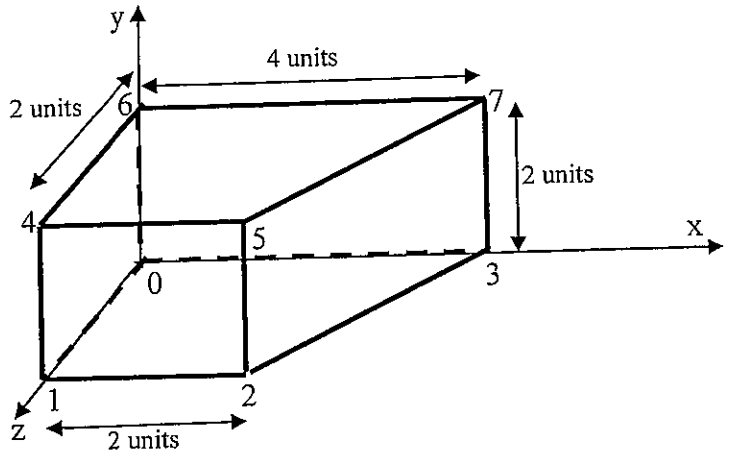
```
glMatrixMode(GL_MODELVIEW);
glLoadIdentity();

i)_____
ii)_____
iii)_____

DrawObject( );
```

Continued...

QUESTION 3

a) (i) Complete the tables of Vertex list, Face list, Normal list and Edge list based on the 3D object below.

[5 marks]



Vertex List

Index	x	y	z
0			
1			
2			
3			
4			
5			
6			
7			

Face List

F_a	F_b	F_c	F_d
4		2	
6		1	
6		5	
0		2	
6		3	
5		3	

Normal List

N_x	N_y	N_z

Edge List

E_i	E_j

(ii) Show that the above object is a polyhedron.

[1 mark]

Continued...

b) Construct the *u-v-n* viewing coordinate reference frame for a camera situated at (1, 0, 5) looking at the center of the origin of the world coordinate.

[3 marks]

c) Z-buffer (or Depth buffer) algorithm resolves visibility independently at each pixel instead of at each polygon or object. It solves the problems occurred in the Back-face Culling method and Painter's algorithm. However, Z-buffer algorithm still encounters some limitations. List down the two limitations.

[1 mark]

Continued...

QUESTION 4

a) A realistic display of a scene is obtained by generating perspective projections of objects and applying natural lighting effects to the visible surfaces. Define the following lighting effects:
i) Ambient light
ii) Diffuse reflection
iii) Specular reflection

[3 marks]

b) Given a viewer at location V (4, 4, 8) and a point light source at location L (-3, 4, 6). Compute the total lighting (ambient, diffuse and specular) cast on a point P (0, 0, 1), where the ambient, diffuse and specular light intensity are $I_a = I_d = I_s = 0.9$, the coefficients of the three light effects are $K_a = K_d = K_s = 0.5$, the Specular reflection exponent, $n = 10$ and the normal vector, $N = (0, 0, 1)$.

[5 marks]

Continued...

c) Texture mapping is a method of adding realism to a computer-generated graphic. An image (the texture) is added (mapped) to a simpler shape that is generated in the scene, like a decal pasted to a flat surface. This reduces the amount of computing needed to create the shapes and textures in the scene. Define the following mapping techniques:

i) Bump mapping

ii) Environment mapping (or Reflection mapping)

[2 marks]

The end!